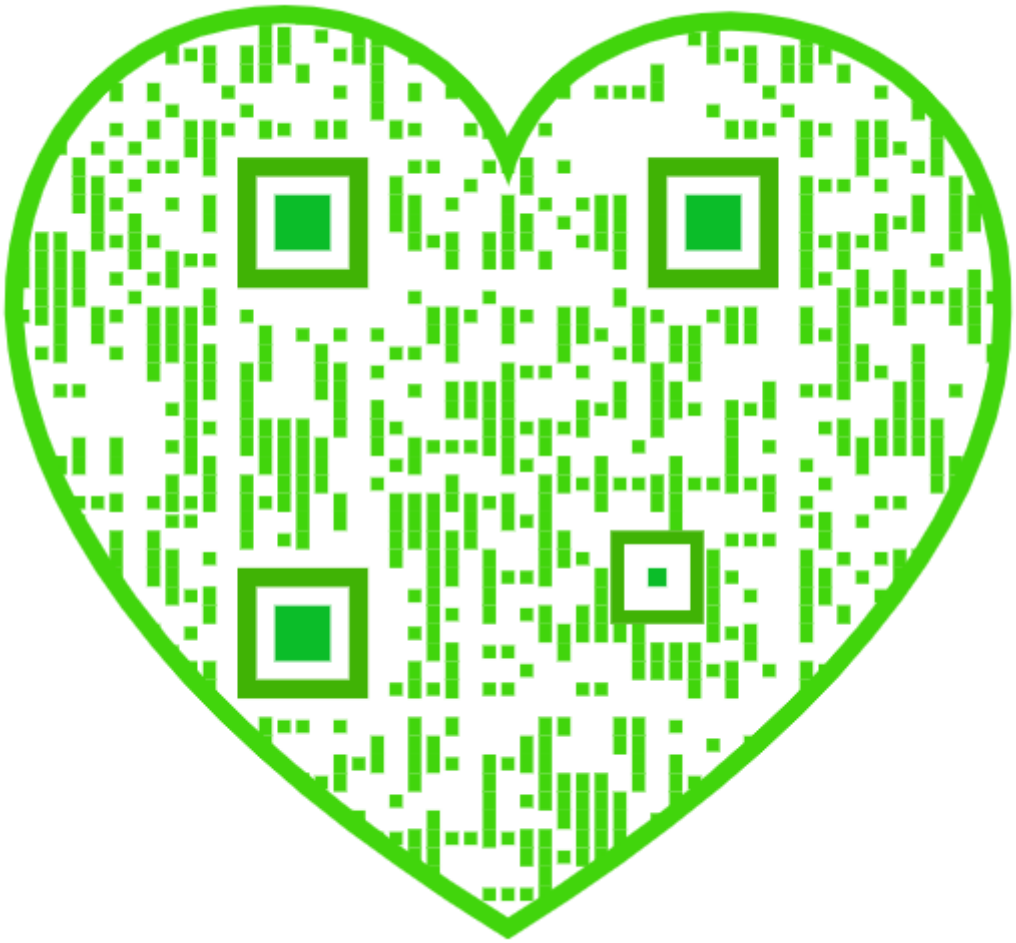

Pan American Union.

BUREAU OF AMERICAN REPUBLICS,

WASHINGTON, U. S. A.

COFFEE IN AMERICA.

METHODS OF PRODUCTION

AND

FACILITIES FOR SUCCESSFUL CULTIVATION

IN

MEXICO, THE CENTRAL AMERICAN STATES, BRAZIL AND OTHER SOUTH AMERICAN COUNTRIES, AND THE WEST INDIES.

SPECIAL BULLETIN. OCTOBER, 1893.

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BUREAU OF THE AMERICAN REPUBLICS,
LAFAYETTE SQUARE, WASHINGTON, D. C., U. S. A.

Director.—CLINTON FURBISH.
Secretary.—FREDERIC EMORY.

M. N.

COFFEE IN AMERICA.

Throughout the world there is a constant and rapid increase in the consumption of coffee. Although there has been a marked increase in the production of this berry in Central and South American countries, the rising prices indicate that the supply is still below the demand. These facts have naturally turned attention to this industry in those regions where the coffee plant thrives, and has prompted many inquiries from persons seeking investment regarding favorable locations, prices of lands and general information upon the subject. To answer fully the many inquiries received at this Bureau on this subject, is the object of this bulletin. Incidentally, the coffee production of the Old World is noted, but attention is chiefly directed to the lands, climates, soils and other natural conditions of growth of plant, methods of propagation, cultivation, handling and marketing of this product in the countries on this Continent, to which it seems probable the world must look for any increase in the present supply.

SOURCES OF SUPPLY.

The coffee plant, indigenous to Asia and Africa, has found its true habitat in the New World, where its production is already many times greater than in the Eastern Continent. Messrs. Schoffer & Co., of Rotterdam, estimated the world's total production in 1884 at 681,314 tons, of which Brazil alone produced 371,429 tons, or 61,544 tons more than one-half the entire product. Java, Sumatra and Celebes produced 108,743 tons. Since that time the proportion in favor of America has constantly and immensely increased; the Old World having hardly increased its production, while in Brazil the crop in 1892 reached about 500,000 tons, and the other American countries had shown, in certain cases, a still greater percentage of growth.

The amount of coffee produced in the world has been steadily

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increasing for many years. The following table shows the production by countries for the ten years prior to 1885:

	Cwt.
French Possessions in Africa and West Indies	16,995
Menado	18,450
Mocha	19,054
Cuba	24,000
Salvador	92,000
Colombia	98,204
Guatemala	120,716
Costa Rica	185,472
Puerto Rico	192,645
Venezuela	230,000
East Indies	412,000
Santo Domingo	606,000
Ceylon	850,000
Java and Sumatra	1,415,105
Total	4,280,641
Brazil	4,250,000

The coffee product of the world for 1888–89 was estimated as follows by the two respective authorities:

The New York Chamber of Commerce gives:

	Pounds.
Brazil	812,000,000
Java	96,824,000
Padang, Sumatra	12,320,000
Celebes, Ceylon, India and Manila	62,720,000
Africa and Mocha	12,320,000
Mexico and Central America	80,640,000
Venezuela	78,400,000
West Indies	94,304,000
Total	1,249,528,000

The *American Grocer* estimates:

Brazil	892,944,000
Other American countries	301,123,744
East India and Africa	220,487,840
Total	1,414,555,584

The latter authority gives the following statement of the coffee situation at the close of the year ending June 30, 1893:

The trade year closed June 30 with deliveries of all kinds in the United States, in comparison with the preceding year, as follows:

Year.	Bags.
1892–93	4,398,549
1891–92	4,411,832
Decrease in 1892–93	13,283

This shows great steadiness of consumption, and should be considered satisactory, in view of the high cost ruling and trade disturbances.

In Europe, however, we find an increase in deliveries, those at the eight principal ports comparing as follows:

Year.	Bags.
1892–93	6,547,679
1891–92	6,392.719
Increase in 1892–93	154,960

Bringing the deliveries of Europe and the United States together, we have the following comparative statement:

Year.	United States.	Europe.	Total.
1892–93	4,398,549	6,547,679	10,946,228
1891–62	4,411,832	6,392,719	10,804,551

These figures show annual deliveries for the trade year of, in round numbers, 11,000,000 bags, or 647,000 tons, which may be accepted as the minimum requirements of Europe and the United States.

For the four calendar years ending December 31, 1892, the average annual deliveries in Europe and the United States were 651,384 tons.

It is fair, with these figures as a basis, to estimate that the world requires an annual supply of 650,000 to 660,000 tons (11,050,000 to 11,220,000 bags), and until the production exceeds this quantity, there is not much chance of a return to the low prices of 1882 to 1886.

THE BRAZIL CROP.

The receipts of coffee in Rio and Santos, for the trade year ending June 30, compare with preceding years as follows:

	Rio.	Santos.	Total.
	Bags.	*Bags.*	*Bags.*
1892–93	2,989,000	3,213,000	6,202,000
1891–92	3,722,000	3,675,000	7,397,000
1890–91	2,413,000	2,945,000	5,358,000
1889–90	2,389,000	1,871,000	4,260,000
1888–89	4,189,000	2,638,000	6,827,000
1887–88	1,912,000	1,121,000	3,033,000
1886–87	3,497,000	2,581,000	6,078,000

Here we have a decrease in receipts at Rio and Santos in 1892–93, as compared with 1891–92, of 1,195,000 bags, a deficit of over 10 per cent of the world's coffee requirements.

The average annual receipts at the two ports of Brazil for five years were 6,008,800 bags, so that the crop of 1892–93 was a full average.

The exports from Rio and Santos for the year ending June 30 and the preceding four years were as follows:

	To United States.	To Europe.	Total Exports.
1892–93—Rio	1,972,000	953,000	6,295,000
Santos	1,102,000	2,268,000	
1891–92—Rio	2,556,000	1,148,000	7,267,000
Santos	997,000	2,556,000	
1890–91—Rio	1,556,000	750,000	5,537,000
Santos	798,000	2,253,000	
1889–90—Rio	1,767,000	724,000	4,570,000
Santos	512,000	1,567,000	
1888–89—Rio	2,332,000	1,542,000	6,431,000
Santos	533,000	2,024,000	

The above shows average yearly exports for five years of 6,020,000 bags, which is 275,000 bags below the exports of 1892–93.

Brazil furnishes about 54½ per cent of the world's requirement of coffee, taking the average exports for five years as a basis of computation.

It is apparent that any decrease in the Brazil supply below a crop permitting of minimum exports of 6,000,000 bags, or 54½ per cent of the world's total supply, means high prices until other producing countries extend their area under coffee to an extent great enough to produce and export an average of at least one-half of the world's requirements—unless Brazil has other years of exceptional yield, as in 1891–92, when the receipts at Rio and Santos went 1,388,200 bags beyond the yearly average.

Coffee culture is being pushed in Mexico, Central America and the United States of Colombia, but new plantations have not yet reached a point where they are able to push exports abreast of Brazil, and until that time is reached high prices must rule. Consumption has not increased since 1886 as much as it should, in view of the increase in population and the prosperous condition of the United States. It requires the stimulus of low prices and exceptional prosperity to advance coffee consumption in the old-time ratio of about 9 per cent per annum.

THE MOVEMENT IN 1892–93.

Taking the official report of the New York Coffee Exchange, we find the position of coffee and movement in 1892–93 to be as follows:

In the United States—

Stocks, July 1, 1892	525,889
Arrivals in United States, all kinds	4,283,239
Total supply	4,809,128
Less stocks, July 1, 1893	410.579
Deliveries, 1892–93	4,398,549

In Europe—

Stocks, July 1, 1892	1,451,134
Arrivals in Europe	6,987,191
Total supply	8,438,325
Less stocks, July 1, 1893	1,890,039
Deliveries, 1892–93	6,547,679

In United States and Europe—

Stocks, July 1, 1892	1,977,023
Arrivals in Europe, 1892–93	6,987,191
Arrivals in the United States, 1892–93	4,283,239
Total supply, 1892–93	13,247,453
Less stocks, July 1, 1893	2,300,618
Deliveries, 1892–93	10,946,835

The total sales for future delivery on the New York Coffee Exchange amounted to 7,911,500 bags for the year ended June 30, 1893, compared with 6,949,000 in 1891–92, 7,700,750 bags in 1890–91, and 13,011,500 bags in 1889–90. The largest transactions for any one month were in April, when they reached 1,175,750 bags. More than one-half of the year's business was done during the first six months of the trade year, when transactions covered 4,157,250 bags against 3,754,250 bags for the six months ended June 30, 1893. The highest price paid was 17.70 cents for March delivery in January, 1893, and the lowest was 11.75 cents for October, November and December delivery in July last.

The average monthly prices of No. 7 Rio for the trade year ended June 30, 1893, based on actual sales, were as follows:

1892.	Cents.	1893.	Cents.
July	13.15	January	17.19
August	13.86	February	18.03
September	15.02	March	17.71
October	16.01	April	15.85
November	16.59	May	15.72
December	16.77	June	16.68

Average for trade year, 16.05 cents.

It is certain that any decrease in the Brazil supply of 1893–94, below 6,000,000 bags, means a heavy inroad upon the world's stocks, with the situation favorable for the producers. The stocks, July 1, in Europe and the United States, were 2,300,618 bags, against 1,997,023 bags, July 1, 1892, an increase of 323,595 bags. In the United States there was a decrease as compared with the previous year of 115,310 bags, while Europe shows an increase of 438,905 bags.

Any view of the situation is subject to modification, owing to the financial troubles which have unsettled the markets of the world. The liquidation in South America, Australia, England and this country, has not been completed, and until it is, no one can predict with any approach to certainty what the course of the coffee market will be in 1893–94. Credits have as much to do with the situation as crops.

VARIETIES OF COFFEE.

The coffee plant (*genus cafea*) indigenous to Africa and Southwestern Asia possesses several more or less known varieties, viz:

Arabian Coffee: Mocha, Myrtle, Aden and Bastard.

Moorish Coffee: Marron of Reunion.

Monrovian Coffee: Coffee of Gabon.

Laurine Coffee.

Yellow Coffee (*café amarello*): The richest of all in cafeine, with yellow berries.

Red Coffee (*café vermelho*): The common coffee of Brazil, Colombia, Guatemala, Venezuela, Nicaragua, Salvador, Costa Rica and Mexico. The berries of this coffee are red when full grown.

The subdivisions of the above-named varieties are quite numerous, some of them being based rather on the district where they are produced, or the port whence they are shipped, than on any real difference in quality or appearance.

Thus we have for Brazil, the Rio Coffee, also subdivided according to class or treatment; Santos Coffee, the coffee of Minas, that of Bahia, of Ceará, etc.

For the West Indies there are the Haiti, Jamaica, Puerto Rico, Martinique, etc. For Venezuela, the Laguayra and Maracaibo. For Bolivia, the Yungas. Central America presents as subdivisions the Guatemala ordinary and Guatemala *gragé*; the Costa Rica, ordinary and *gragé*, etc. All these classes or subdivisions, however, belong to the Red Coffee variety.

It is a well-established fact that the quality of coffee—that is, its flavor and aroma—is improved by keeping, and it is thought to be at its best at eight years, provided it has been kept in a perfectly dry place and atmosphere. As it is sold by weight, and as it loses by the evaporation of the water contained in the freshly prepared beans, dealers prefer to sell it as green as possible. When at its best, its color should be a pale yellow, for the usual variety; and greenness of color is an evidence of immaturity or of artificial coloring. Such coffee should be avoided.

The following table will show the great variation in the size and weight of coffee from different sources:

WEIGHT.—DENSITIES OF OLD COFFEE.

Origin.	Date of crop.	Condition of the grains.	Weight per litre.	Number of grains to the decilitre.
			Grammes	
Mocha (*Admiral de Rigny*).	1828	Grains regular, fine.	500	510
Mocha of Aden	1874	Much mixed	606	554
Zanzibar Mocha	1874	Much mixed	600	476
Java	.....	Regular, large	445	338
Reunion	1869	Fine, pointed at the ends.	630	488
Brazil	1872	Regular, large	522	294
Brazil (Rio) No. 16	1867	Regular, large.	460	300
Brazil (Rio) No. 17	1871		544	292
Brazil (Rio) No. 18	1872		586	354
Venezuela	1865	Ovoid, medium	654	400
San Salvador	1873	Ovoid, medium	662	.....
Cochin China	Very Dry.	Small	614	544
Rio Nunez		Small	580	618
Nossi Be		Medium	584	432
Nossi Be (*Wild*)		Ovoid, very small.	440	752
Gabon		Large, irregular.	490	336
Caledonia		Medium	570	442
Ceylon	Medium Dry.	Fine	580	452
Brazil (*Espirito Santo*)	1875	Large (*artificially dried*).	567	318

Its loss of weight by drying is shown by the following—the density being:

	Grammes.
For eight years	4.60
For four years	5.44
For three years	5.86

Since 1885 the production has increased enormously. Brazil alone produced for exportation in 1891–92, 7,000,000 bags of 132 pounds each, showing that its exports for this year exceeded the total production in 1888–89 by over 100,000,000 pounds. The exports of coffee from Mexico for 1888–89 were to the amount of $3,886,034, and $1,019,066 for the first six months of 1890–91. Costa Rica produced, in 1889–90, 33,363,200 pounds; Venezuela, 95,170,272; Colombia exported in the latter year to the value of $4,262,030, and Guatemala 50,859,900 pounds, valued at $2,714,981. Nicaragua produced in 1890–91 11,300,000 pounds.

While the total production of the world has thus been increasing, the ratio of this increase has been far greater in the countries that make up Latin America than in the coffee producing districts of the Old World, where the once famed plantations of Arabia have dwindled to an insignificant production, and the difficulties of cultivation in Java have increased. It is in the former, therefore, that the steadily growing demands shown by the constantly increasing price must stimulate the opening of new fields.

RANGE OF PRODUCTION.

The plant is a native of the tropics and can be cultivated only in regions free from frost, though excessive heat is inimical to a healthy growth or good product. Thus, in the low, hot lands of the entire coast of the Gulf of Mexico, Caribbean Sea and South Atlantic, its cultivation is not attempted; and it is only back on the high lands and hill ranges that successful plantations are found.

Mexico is the most northern and Paraguay the most southern of the countries of this Continent, where its cultivation has been profitably pursued, and the area of territory in each of the countries where it is grown that can be successfully devoted to the production of coffee is much less than is generally supposed.

The following information as to this industry has been gained from those having personal knowledge of coffee culture in the different localities:

MEXICO.

In regard to coffee raising in Mexico, Maj. J. D. Warner, of the the City of Mexico, says, in the *Mexican Trader*, under recent date:

Coffee raising in Mexico is yet in its infancy, but it pays from 100 to 200 per cent on the capital invested, the Mexican coffee being of a superior quality and ranking among the best in the world. Coffee is worth at present, at the plantation, from 20 to 25 cents per pound, while the annual cost of production averages only 7 cents per pound, the coffee being sold for cash only, and never commissioned out to find a market. Good coffee land with an exceptional title can be bought for from $5 to $100 an acre, according to location and condition, and an acre will grow 1000 trees.

He states that the coffee plantations of Mexico are never attacked by any disease or parasite; but in a document published by the Department of Industry and Commerce of that country, in 1883, among other insects injurious to the coffee plant, one, the *gallina ciega*, is mentioned as attacking the roots and doing much damage to the plant.

The altitude recommended for the establishment of plantations is from 1000 to 3000 feet above the level of the sea, and such localities are the healthiest to be found in the tropics, being above the level where yellow fever and malarious diseases usually prevail.

The gathering of the crop is largely done by women and children, and labor is not difficult to obtain. Major Warner states that the average of wages paid in the coffee raising districts is 43¾ cents per day.

Señor Romero, Minister of Mexic oin the United States, in a work on coffee culture published in 1875, estimates the cost of each coffee tree, four years from planting, at about 11 cents, including price of land and wages; that the tree in its fourth year will yield two pounds of coffee, which, at a minimum price of 10 cents, makes 20 cents per tree. The expense of gathering and preparation for market he puts at 5 cents, thus leaving a net profit of 15 cents per tree. With 1000 trees per acre, the net profit per acre is seen to be $150 for the fourth year. The yield increases, ordinarily, to the seventh or eighth year.

The following remarks and directions in relation to coffee planting in Mexico are taken in substance from the government publication referred to above, and may, with some unimportant modifications, be applied to the cultivation of coffee in all American countries that produce it:

CULTIVATION OF COFFEE.

The soil most generally suited for coffee plantations is a friable, sandy, or even gravelly one, though the presence of clay in considerable amount is not objectionable, when the drainage is good; but soils that retain standing water, or those formed chiefly of alluvium, while they produce vigorous trees, do not yield coffee of good quality. The best soils are sufficiently deep to allow the roots to penetrate vertically to a distance of three feet or more, and should not rest on a substratum of solid rock or impermeable clay, as the moisture would be too long retained, and the plants injured. For this reason it is always advisable, in selecting ground for a coffee plantation, to make sure that the above conditions, as nearly as possible, exist; otherwise disappointment and failure may result.

It must not be supposed, however, that moisture is not necessary for the healthy growth and production of plant and fruit; for unless there is abundant moisture afforded by nature, in the way of rains and dews, artificial irrigation will be needed. The essential thing is that the moisture pass freely through the soil and not be retained standing about the roots of the plant.

The best plantations are made on virgin soil, from which a forest growth has been removed by cutting the trees and burning the branches and undergrowth on the ground, as the ashes are an excellent fertilizer, whose properties are lasting. Hillsides are usually selected to secure better drainage, and eastern exposures are preferred, though not essential to the growth of productive plantations. Next to eastern, the western slopes are preferable, as on either of these the growing plants are not exposed all day to the direct rays of the sun, as is the case with northern and southern exposures.

Many planters are of the opinion that burning over the ground injures it, and no doubt this is the case if the whole forest growth be burned, as is sometimes done; but when only the branches of the

fallen trees and the undergrowth are consumed by the fire, the general opinion is that the ashes are valuable as a fertilizer for the coffee plants. In Brazil, the fallen trunks of such trees as make valuable timber are sawed by hand by gangs of men, who go about the country for that purpose, since saw-mills are scarce, and the transportation of the heavy hard-wood logs would be almost impossible. Some of these woods are almost as hard as iron, and the sawing is difficult and very slow.

The plants for the future plantation are raised either on the spot where they are to grow, or in seed-beds, to be afterwards transplanted to their permanent place. The latter mode is that most generally preferred, as by it plants without defect may be selected, and of uniform size, which is not possible under the former system.

If the former method be chosen, however, the ground, cleaned of all growth, is staked off in lines, in which the seeds are planted, a few to each hill, at from six to eight feet apart. The rows are not so far apart as the hills, for these are arranged in the quincunx order—that is, three hills form the vertices of an equilateral triangle, two of them being in one line and the third, or vertex of the triangle, being in the next line. The distance apart of the plants, then, being represented by a, the distance of the lines from each other will be the square root of $\frac{3}{4}a$. This arrangement gives each plant the same root area as to every other one, and in situations when the plough can be used, allows cultivation in three directions. Of course the soil where the seeds are deposited must be thoroughly and deeply stirred. This is done by long, sharp spades, made especially for the purpose, and the holes are dug some two feet square and to about the same depth, in order that the roots may easily penetrate the soil in all directions. The earth removed from the hole is so replaced that what was at the top shall be at the bottom.

As the young plants need to be protected from the burning rays of the sun, banana plants, which are of very rapid growth, are set at the centers of the triangular spaces; or, as the banana propagates so rapidly and is so difficult to extirpate, when the coffee plants require the whole ground, many prefer to plant the wild fig, or some other plant easier to eradicate. In Brazil it is usual to plant a kind of tall coarse pea, called *guando*, which shades the ground effectually, prevents the soil from washing away, and is allowed to fall and decay

on the ground. This plant is selected because it is rich in potash and affords excellent manure for the growing coffee plants.

As the ground rarely admits of cultivation with the plow, the soil is kept free from weeds by the use of heavy, sharp hoes, and the bushes that spring up are cut down with mattocks or grubbers; all the work being done by hand. During the first season, particularly, it is important that all weeds and grass be destroyed before going to seed, thus preventing new generations from appearing in subsequent years to increase the labor of cultivation. The burning of the brush on the ground, in the preparation of the future plantation, destroys many seeds that would otherwise produce weeds.

After the seed is planted, if no rain falls, irrigation will be necessary to prevent the earth about the germinating seed from drying, as in that stage moisture is necessary to the life of the embryo plant. Care should be taken, however, that the irrigation be not excessive, as too much water is as injurious as too little. After the roots have formed and penetrated deep into the soil, the plant resists drought more easily. Of course, if several seeds germinate, the most vigorous plant is preserved and the rest removed, after a short time, or before the roots of various plants have become mingled together, so that in removing the others the roots of the one selected to remain shall not be disturbed.

The propagation of the plants in seed beds, which, as has been said, is the course usually pursued, is as follows: A spot of ground of the same quality as that of the proposed plantation is selected; since, if the seed bed be more fertile than the soil of the plantation, the young plants will start off with a vigorous growth, which will be injuriously checked by transplanting to a soil less rich. At the same time, the seed bed should not be lacking in the elements of vigorous growth, as puny plants rarely become vigorous, even when removed to a very fertile soil. Very much, then, depends on a proper relation of fertility between the soil of seed bed and that of the permanent plantation.

The location of the bed should be such that it will receive the rays of the sun during the forenoon, and remain in comparative shade after midday. The seed bed is thoroughly prepared by stirring and inverting the soil, and the seeds may be planted in ridges or in boxes set in the ground, having not less than ten inches of earth. Seeds

that are perfectly sound and regular in shape and size should be selected and planted about two and a half inches apart. They should be covered with vegetable mold to the depth of about three-fourths of an inch, and the whole seed bed well sprinkled from a watering pot immediately after the planting.

All grass and weeds must be carefully removed from the bed as they appear, and the earth watered whenever it appears dry, which is best done late in the afternoon. Frequent light sprinklings, which keep the soil in an even condition of moisture, are preferable to profuse watering at long intervals, which makes the earth alternately too wet and too dry.

The young plants begin to appear in about a month, and in ten or twelve months are ready for transplanting, being, at that age, from twelve to sixteen inches high. The banana or other plants intended to shade the young coffee trees should be set out before the transplanting of the latter, and given time to become large enough to furnish shade from the first. The cultivation of the new plantation will consist in keeping down the weeds and grass, and if these should grow to considerable size it is better to cut them down, allow them to dry, and burn them in piles, than to cover them with earth. Many insects and their eggs, or larvæ, are destroyed by the burning, that would not be killed by burying them.

The transplanting is done when the ground is moist from recent rains, and if a ball of earth be taken up with the roots of the young plant, it will start off more quickly and vigorously in its new place. If the plants destined to furnish shade have not been previously planted, it will be necessary to stick a branch with leaves in the ground beside the young plant, so as to shade it until it takes new root; but these branches should not be left there longer than necessary, as they become the breeding place of insects which are injurious to the coffee plant.

If the roots of the plants are torn in removal, they should be cut obliquely and smoothly above the wound. The plants can be conveniently carried from the seed bed to the plantation in large baskets, whose bottoms are covered with moist earth. The direct rays of the sun should not be allowed to fall on the plants during their transportation and planting. The plants should be set at the same depth as

in the seed bed, and the ground about them watered in the afternoon of the day of transplanting.

In addition to keeping the new plantation free from grass and weeds, the suckers or shoots which will push at the base of the plant should be removed, as well as all diseased branches and such as lie on the ground. Some of the plants will die, and these must be replaced by the most vigorous ones from the seed bed.

Some planters think it best to pinch off the terminal buds of the top boughs when the plants have reached a height of five or six feet. This is to prevent the tree from growing too high for the convenient gathering of the berries. Others believe that this process injures the quality of the coffee, an opinion apparently ill-founded, since the general practice is to top the trees, which makes them more stocky and the lateral branches stronger. In the forest, surrounded by other trees, the coffee tree grows tall and straggling and produces but little.

A Mexican authority declares that the coffee tree will not bear pruning, but in Brazil and other countries it is freely practiced. The distance of the plants from each other varies considerably in different countries and localities. In Costa Rica it is recommended to give them a distance of ten feet. In Brazil, from ten to twelve feet is the usual distance, while in Mexico six, seven or eight feet seems to be preferred. No doubt the size of the tree at maturity is that which determines the proper distance under the system of pruning that is practiced. A distance of ten feet in the quincunx order of planting will give about 500 trees to the acre.

Generally, if the soil of the plantation is originally of sufficient fertility, little or no manures will be required, if the leaves that fall annually from the trees, and vegetable growth that is raised between the rows are turned under the soil to decay; but where manures are necessary or desirable, the vegetable should be preferred to the animal. Ashes are an excellent application, as the coffee plant is a consumer of potash.

If the ground of the plantation is very steep and the soil inclined to be washed away, it is better not to keep it too clean of grass and weeds, as these retain the earth by their roots and stems that lie on the ground; and sometimes diagonal ditches must be made to carry

:he excess of water more slowly than it would descend the slope nobstructed.

Although there are few plants less exposed to the attacks of ects and disease, the coffee has certain enemies, both animal and gus, which require attention, but none of these present great diffi-ties in overcoming. A growth of moss is probably indicative of much moisture and a generally feeble condition. Very few spe-c remedies are employed against insects, which are rarely very midable.

The trees begin to produce in the fourth year, and in the seventh ach their full capacity. A coffee plantation favorably located and operly cared for will continue in profitable bearing some forty years.

Mexican coffee is considered to be milder and, in some respects, perior to the product of some of the other coffee producing ountries. There remain still in Mexico vast bodies of virgin land. nited States Consul Sampson, at Paso del Norte, in a report dated ne 17, 1891, represents that nearly one-third of the lands of the epublic are unoccupied, the greater part of which are available for gricultural and pastoral purposes. Among this are many tracts hich may be profitably devoted to coffee culture. Any settler may btain as many as 6000 acres of government lands at prices varying om 12 cents to $1.80 per acre. The Mexican government offers very encouragement to actual settlers. To settlers in colonies, as uch as 247 acres are granted free, and the colonies will receive a itle to the same after having cultivated the land for five consecutive ears. The settlers are also exempted for the period of ten years rom military service, from all taxes except municipal, from all mport or domestic duties on articles imported for their own use, and rom export duties on their products. Public lands may be obtained n any part of the Republic where they are situated, except within ixty miles from the frontier. In sections suitable for coffee culture, obacco, vanilla, ramie, Indian corn, etc., may also be raised.

GUATEMALA.

The production of coffee in Guatemala is steadily, though not rapidly, increasing. In 1887, the production was 48,539,267 pounds,

and in 1891 it had advanced to 52,197,853 pounds. Between 1861 and 1870, only 11,481,420 pounds were exported, but between 1871 and 1883 the exports of coffee reached 293,274,971 pounds.

The temperature best suited to the healthy growth and abundant production of the plant in Guatemala is between 60° and 90° Fahrenheit, the former being rather too cool and the latter too warm for the best results. In the lands whose altitude is from 1500 to 2000 feet, and where the ruling temperature approaches the latter limit, the young plants must be shaded, in new plantations, by tall and rapidly growing plants, otherwise their growth is unhealthy, as is betrayed by the small size and yellowish appearance of the leaves.

For the purpose of shading the young trees, the banana is very generally employed; as it not only affords abundant shade, but produces paying crops of its own. After one or two seasons' growth ,the coffee plants need no further extraneous shade.

In districts whose mean elevation is 4500 feet, plantations must be sheltered from the cold north winds, which, during December, January and February, blow almost continuously, and destroy plantations exposed to their full force. A range of hills to the north of and overlooking the plantation is the best natural protection that can be found, but in the absence of this, it is customary, when the mercury at night falls to 60°, to burn heaps of rubbish mixed with pitch on the north side of the plantation, and the dense smoke, drifting over and through the rows of trees, furnishes complete protection from the effects of the cold.

The scarcity of labor has been, and continues to be, the main obstacle to a rapid increase in the coffee product in the extensive lands of Guatemala so well suited to the growth of the plant.

Mr. Audly Gosling, in a report made to the British government in 1892, says that lands suitable for coffee plantations may still be had at moderate prices, and that the production would be increased three or four times if sufficient laborers could be obtained for new plantations. The lands most suitable for plantations and most favorably situated with respect to centers of shipment naturally command the highest prices.

For the better and more favorably located lands, the government price is about $80 per caballeria (120 acres), $40 to be paid to the authorized surveyor; making, in all, about $1 per acre. This,

however, is the price when there is no competition among bidders. Mr. Gosling thinks that the most inviting fields are the districts more remote from the cities, and that in these, well-directed energy and moderate capital may expect abundant rewards from coffee raising.

The manner of raising the plants and setting them in the permanent plantations is almost the same as in Mexico, and the same cultivation is given to the growing trees. The critical season for the future crop is the blooming period. A heavy rainfall, while the trees are in flower, will seriously damage the plants, washing away the pollen and thus preventing fructification. This period lasts three or four days, when the blossoms fall and the "cherry," as it is called, begins to appear. This "cherry" reaches maturity in October and is ready for gathering and "pulping"—that is, for the removal of the outer shell and pulp, after which it is washed and carried to dry, spread out in brick-paved yards exposed to the sun.

The methods employed for the handling of the berries after gathering may be greatly improved, and when the modern machinery and drying apparatus, such as are used on the larger plantations in Brazil, shall have been introduced, the Guatemala product will be greatly improved, both in quality and amount. The profit, too, of the culture, in a country where labor is so scarce, must depend greatly on the employment of all means which will economize manual labor.

German settlers have taken up coffee lands to such an extent that it is estimated that fully one-fifth of the plantations are in their hands.

Lands in Guatemala may be readily acquired by foreigners, at prices that vary according to their situation, quality, etc.

Level lands covered with natural pasture are sold at $2 per hectare (2½ acres). If level and covered with brush they bring $1.50 per hectare, if they yield sarsaparilla and other valuable natural products, and $1 if without such products. Broken, stony, miry and sterile lands are sold at 80 cents per hectare. Vacant public lands sixty miles or more distant from the nearest center of population may be obtained at one-fourth the above prices. Settlers introduced into Guatemala, or through the government Bureau of Immigration, may obtain concessions, of public land without payment and will receive a title to the same on fulfilment of certain easy conditions. Settlers are also exempt, for ten years, from any direct tax or impost,

and are also free from military service, and are entitled to introduce, free of duty, such tools, implements and machinery as are needed for their work. After becoming firmly established they may allow the foreigner to pay taxes on their importations, as in other countries.

HONDURAS.

The soil, surface and climatic conditions of Honduras are so similar to those of Guatemala that the cultivation of coffee is almost identical in all respects, and the yield and profits are about the same. As in Guatemala, scarcity of labor is the chief obstacle to coffee-raising, and the government, recognizing the importance of immigration for the development of the public lands, offers them to settlers at very low prices. Senor Jeronimo Zelaya, delegate from Honduras in the International American Conference, informed the Bureau of American Republics that lands on the northern coast may be obtained gratis, on application to the government.

The prices of land, when sold by the government, vary from 25 cents per acre, when suitable for pasture only, to 50 cents, when fit for agricultural purposes. Lands situated within a league of a navigable body of water are sold at 75 cents per acre, and those exceptionally located, or possessing particular advantages, bring $1 per acre.

United States Consul Herring, speaking of the various products of Honduras, says its "coffee is perhaps without a superior in the world," and while it is true that the cultivation of the plant has not been extended so rapidly as in some other of the Central American States, it seems that the field offered for enterprises in that direction is not less inviting than in the neighboring countries.

NICARAGUA.

Coffee is the staple product of Nicaragua and the annual yield has continued comparatively steady during the last ten years. In 1881–82 the production was 120,262 quintals, and in 1890–91 113,000 quintals; showing a slight falling off. There are under cultivation in coffee about 76,000 acres, and each acre is estimated to produce five quintals. (A quintal equals 220.46 pounds.)

The lands in this Republic suitable for coffee raising are found on the Sierra de Managua, the greater part of which is adapted to that purpose; in Diriamba, San Marcos and Jinotepe, and about the base of the volcano Monbacho, near Grenada. Good coffee lands are also found on the Island of Ometipe, in Lake Nicaragua, and around Boaco, in the Department of Chontales, where the cultivation has only recently begun. There are also many flourishing plantations near Matagalpa and Jinotega, and in the vicinity of Esteli and Lomato, in the Department of Nueva Segovia.

Water is scarce on the Pacific Coast lands, but in the Departments of Chontales and Matagalpa, is abundant. Communication between the districts and centers of population is, for the greater part, by roads where only mules can travel, though some of them will admit of transportation by wagons and carts. The altitude of the coffee lands is from 3000 to 4000 feet above sea level, at which height the atmosphere is pure and residents enjoy excellent health.

Labor is more abundant in the northern than in the Pacific departments, and wages of laborers vary from 40 to 50 cents per day. In the northern departments, too, are many streams that can be utilized to afford motive power for machinery; also, rivers of considerable size.

For the exportation of coffee, the principal roads are the National Railway from Granada to Corinto; the route by steamer from Granada to San Jorge, on Lake Nicaragua, and thence by wagons to San Juan del Sur; and that from Granada to San Juan del Norte, on the Atlantic. Freight on coffee from Granada to Corinto is about 60 cents per 100 pounds.

In order to encourage the establishment of coffee plantations the government of Nicaragua does not place a penalty upon industry in the form of a license tax, but has ade a law, by which, to every person planting not less than 5000 coffee trees, a premium of 5 cents per tree is given; one-half of which is payable when the trees are 2 years old, and the remainder when they begin to produce. From 400 to 500 trees are set to the acre, and the cost of the plants is about $5 per 1000. The expense of clearing the land for plantations is placed by the United States consul at Managua at from $3 to $12.50 per acre. The same authority estimates the cost of producing 100 pounds of coffee at $5, which leaves a handsome margin for profit.

The price of government lands suitable for agricultural purposes is about 75 cents per acre; for such as are well watered with running streams, $1; and for those containing valuable building timber and dye-woods, 20 cents per acre additional.

The consul above cited advises no one to go to Nicaragua to establish himself as a coffee planter with less than $3000 or $4000 capital.

The methods of opening new lands for plantations, raising the young plants, setting them in the plantations, the gathering and handling of the product are the same as those employed in the countries already treated of.

Consul Newell, at Managua, in his report dated June 13, 1891, estimated that the total area in cultivation of coffee in Nicaragua amounts to about 28,000 acres. He further states that the amount of public lands pre-empted December 31, 1890, was about 48,000 acres, of which 32,000 were fit for coffee cultivation.

The greater part of the coffee exported goes to Europe. This is owing, in part, to the fact that rates of freight to the United States are higher, and in part to the better facilities offered by European houses to shippers of coffee.

According to the same report, there were at that date in the department of Matagalpa, 2,000,000 trees, which, in the beginning of 1893, would begin to produce. His estimate that these trees should produce 10,000,000 pounds of coffe is clearly too high, since such a yield would require an annual product of five pounds per tree; whereas, the yield per tree, as estimated in another part of the same report, is about one pound.

The departments of Masaya, Managua and Matagalpa, appear to contain the greater of the lands adapted to coffee culture. Out of 17,000 acres of land pre-empted, only 120 acres were not suited for coffee plantations; and out of 13,000 acres in Managua, over 8000 were fit for coffee.

COSTA RICA.

The coffee plant was introduced into Costa Rica in 1796, and its cultivation there has been continuous since that time, the production gradually and constantly increasing under the Spanish occupation and

since the independence of the country, reaching 5000 tons in 1861 and 18,000 in 1884. The exports of coffee in 1891 amounted to nearly $6,140,000. Costa Rica coffee is of a superior quality and commands the highest price in the market. It is largely used in England.

The census of 1890 showed the existence of 8130 coffee plantations, with 26,558,251 trees. These plantations were situated at various altitudes, from 2500 to 5000 feet above sea level, but the best results are obtained at 4000 feet.

The method of raising the young plants in nurseries, the distance at which they are planted, the preparation of the virgin lands for the plantations, and the subsequent cultivation of the trees, are the same as in the other coffee districts of the Western Continent.

The seed beds are sown in May, and in the same month of the following year are set in the plantations. At the end of two years a few berries will be produced, the first regular crop being harvested the following season. The cultivation of other crops between the rows while the trees are young is practiced to some extent, as elsewhere; the banana, or a quick-growing tree called "poro blanco," being used to shade the young plants. The average annual cost per acre of working a coffee plantation after it comes into bearing is estimated at about $6, and the annual yield is put at an average of 2500 pounds per acre; but 2000 pounds is a safer estimate.

The quincunx order of planting the trees in the plantations of Costa Rica is not so common as in the other coffee producing countries, notwithstanding its obvious and considerable advantages.

The gathering, which goes on from December to March, is done largely by women and children, who pick the berries in baskets holding from eighteen to twenty quarts. The gatherers are paid about 12 cents per basket, and active workers can fill eight to ten baskets per day.

The provinces of San José, Alajuela, Cartago and Heredia and those in which the cultivation of coffee is most extensively pursued, and in all these, except Cartago, the greater part of the available lands are already occupied by plantations. A vast extent of excellent coffee lands is found on the Atlantic side of the country between Cartago and Reventazon, and are said to be even better than those of Heredia and San José.

The Costa Rican Government encourages the settlement of foreigners in the country to engage in agricultural pursuits, and offers lands at very low prices, considering the great productiveness of their soil.

Public lands may be acquired by pre-emption, in tracts of not less than 120 acres, by merely fencing them and giving notice to the authorities of the intention of the occupant to put them under cultivation; and if the cultivation be carried on for two years, a patent of ownership will be issued to the holder, and he may inclose and claim in the same manner another 120 acres, and so on.

Lands may also be purchased, in areas not to exceed 600 hectares for each person, at public auction, at prices varying from 80 cents to $2 per acre, according to locality, quality, irrigation and nature of growth on them. If the lands at these prices are situated more than fifteen miles from a town of 3000 inhabitants, or from a railroad, these prices will be reduced one-half; if from thirty to sixty miles, they will be sold at one-fourth, and if more than sixty miles, at one-eighth the prices named. These lands may be paid for in cash or in ten annual instalments, at 6 per cent interest. If at any time the purchaser shows that the improvements he has made are worth double the interest due, he is excused from payment of such interest; and if the improvements be worth twice as much as the price to be paid, by the terms of the sale, he is exempted from payment of all interest due.

SALVADOR.

Coffee is the principal production of this country and amounts annually, according to official publication, to about 60,000,000 pounds. The lands most productive of this staple are situated in the departments of Santa Ana, La Libertad, San Salvador, San Vicente, La Paz and San Miguel. The great profits realized in coffee raising in these departments have stimulated the opening of new plantations on a large scale

As in the other Central American States, an altitude of about 3000 feet above sea level is preferred. The methods of preparing the soil, planting the trees, cultivating the plantation, gathering the crop, and preparing it for market, are the same as are followed in the neighboring states.

Want of railroad transportation and of properly constructed roads, together with the difficulty of securing sufficient laborers, is here, as in the other coffee producing States of America, the chief obstacle to enterprises in coffee raising. There is only one railroad in the country, and its length is only a little over forty miles. Others are projected, but it must be many years before the coffee producing districts can substitute transportation by rail for mule trains.

COLOMBIA.

The exports of coffee from Colombia in 1889 amounted to 3,516,293 pesos, equivalent to about $2,155,500 in United States currency, and in 1890, the exports rose to $2,613,000, showing a considerable increase in the production, and being larger by more than $1,000,000 than the gold exports, which come next in value.

The profits of coffee raising in Colombia are no doubt considerable and almost certain, when the proper locality is selected and the necessary capital and intelligent management are employed in the establishment of the plantations and their subsequent care and cultivation. The cost of the land for setting out and growing 100,000 coffee plants, and of implements and cultivation needed, is thus estimated by an intelligent American, who examined various localities and studied the question of coffee cultivation on the spot:

First year	$5,567
Second year	5,414
Third year	1,754
Fourth year	3,000
Machinery for cleaning the berries	2,000
Total	$17,735

The same gentleman gives the yield of the coffee tree from the third year forward as from two and one-half to four pounds per tree each year. This estimate is probably too high, but even at one pound per tree the product of 100,000 trees would be worth $20,000 for the fourth year, at 20 cents per pound

The cost of transportation from Bogotã to New York is estimated at 2.9 cents per pound, and the *Estadistica Mercantil* puts the cost of

production at 4½ cents per pound. The profit is thus seen to be very substantial.

The price of labor is low, the wages of a day laborer being about 25 cents, and in some districts children are employed in gathering coffee at the low wages of 5 cents per day, according to the statement of the gentleman before alluded to.

The coffee plantations of Colombia are said to be remarkably free from disease, and the equatorial situation of the country renders it easy to find localities where the temperature is just suited to the growth of the coffee tree, and but slightly variable. It is simply a question of altitude, and the mountainous character of the surface facilitates the selection of the proper height at which to establish plantations.

Irrigation is said to be rarely necessary in Colombia, and almost the only drawback to the rapid extension of coffee planting appears to be the scarcity of labor, the adequate supply of which is the only great unsolved problem that confronts all proposed enterprises in Central and South America.

Many plantations produce in the third year almost enough to pay for the expense of the cultivation up to that time.

The plants are set about nine feet apart, so that an acre will contain about 460 trees. The manner of cultivation, pruning, gathering and cleaning, is almost the same as prevails in the coffee-producing countries already treated of, and needs not to be repeated here.

The districts in which coffee is profitably produced lie at altitudes varying from 1500 to 5000 feet above sea level; but the tree thrives and produces best at the mean of these two extremes. Considerable quantities of coffee are gathered by the Indians from trees that grow wild on the mountain slopes; and this coffee is the same as that produced in the cultivated plantations, except that the size of the berries is generally smaller.

The consul-general of the United States at Panama states, in a report to his Government, dated April 8, 1891, that there is no limit to the amount of land that may be acquired by settlement and cultivation in the Department of Panamã. Every person occupying uncultivated public lands for agricultural purposes acquires the right of property in the land he cultivates, whatever its extent; and if such

occupation be made by the establishment of coffee plantations, the settler has the right to claim an extent of land adjoining equal to that already occupied.

Sr. Climaco Calderon, the consul-general of Colombia in New York, referring to Colombia in general, says: "The government of Colombia does not offer special inducements to immigration. Bona fide immigrants are allowed in Colombia twenty-five hectares (about sixty acres) of public land and the importation, duty free, of all the implements and tools of their trade and profession."

VENEZUELA.

Venezuela ranks next to Brazil, and, therefore, second among the coffee producing countries of America. The exports of that product in 1890 amounted to 71,167,850 bolivars, or $13,685,577 in United States currency. The importance of coffee culture in the country is seen when it is known that this amount was about three times the value of all the other exports combined.

That large districts in Venezuela are admirably suited for the growth of coffee is thus placed beyond a doubt, and the production already reached promises to make this Republic some day a rival of the great country on her southern border.

The first coffee planted in Venezuela was near Caracas, in 1784, and the seed from these first plants, distributed through the country, formed the beginnings of the future plantations. It is estimated that the lands already occupied by these plantations amount to 346,000 acres, containing about 168,000,000 trees.

A large portion of the mountainous part of the country, in the northern part, is well suited to coffee raising, and can be brought under cultivation with no greater expense than lands in the other countries that produce the plant.

The coffee of Venezuela is undoubtedly of as good quality as that of the neighboring countries. It may be remarked that here, as well as elsewhere, it is the same plant, the same species, the same variety, that produces nine-tenths of the American coffee, and that, as in the hotter countries, a higher altitude is necessary than in the cooler; or, in other words, about the same temperature is necessary for its profitable production, and about the same qualities of soil, the

quality of the coffee produced depends more on the seasons, the cultivation, and handling than on any special adaptability possessed by any country within the coffee zone.

About the same altitude is necessary for successful results as in Colombia, and the same mode of establishing the plantations prevails, except that the trees are planted rather closer together than in Brazil and Central America. A gentleman who has resided many years in Venezuela estimates that about 676 trees are contained on an acre, and that the average product per tree is one pound. He states the cost of handling and preparing for market at about $5.40 per bag of 110 pounds, and the selling price at $17 to $21—giving a profit of over $13 per bag. This would give a profit of about $75 per acre for the plantation. The adoption of the modern improved machinery for the cleaning and drying of the berries, by lessening the cost of handling, and the amount of inferior coffee, will doubtless increase the profits of coffee raising in Venezuela, as it has done in other countries.

Under a decree signed on the 7th day of January, 1893, several provisions were made by the government of Venezuela for the encouragement of immigration. Under this decree immigrants are divided as follows:

First. Immigrants without contract, coming in search of some occupation in this country.

Second. Immigrants coming under contract between themselves and the government of some one of the States.

Third. Immigrants coming under contracts between themselves and private individuals or companies.

Fourth. Immigrants under contract to work in colonies belonging to private persons on vacant public lands.

Fifth. Immigrants under contract to work in colonies belonging to private persons on their own private lands.

Sixth. Immigrants under contract to work under the direct management of the government.

A board of immigration was created to carry out the decree. The board is known by the name, "Central Board of Immigration," and may establish subordinate boards throughout the Republic.

For the purpose of promoting immigration, the government

grants all immigrants voluntarily coming to the country the following assistance:

First. The payment of their passage, both by sea and land, from the place of embarkation to any of the main immigrant depots. The national government may also pay the passage of the immigrants from the place of residence to place of embarkation.

Second. Payment of landing expenses and board and lodging of the immigrants for thirty days after arrival.

Third. Admission, free of duty, of their wearing apparel, domestic utensils and instruments of their calling.

Fourth. Exemption from the payment of any fees for passports given them.

Special provisions are made for the care of the immigrants, who are guaranteed all the rights accorded by law to aliens, and if they choose to be naturalized, they shall be exempt from military service during the whole of their lives, except only in case of foreign war.

Special provisions are made in behalf of individuals and companies organizing colonies for settlement in Venezuela.

The manner of making contracts with immigrants is carefully guarded in this decree.

Such immigrants as may purchase public lands during the first two years of their residence in the Republic shall not be bound to pay the price thereof until after the expiration of four years, counted from the day on which they enter into actual possession of the purchased land; but they will not be allowed to sell or transfer said land during this period.

The patent, or title of ownership, shall not be delivered to the immigrant until after he has paid the stipulated price and given sufficient proof both of his residence on the tract of land referred to, and of his having put the same under cultivation.

The prices to be charged under the decree for national lands are as follows: For agricultural lands, $3.12 per acre, and $386 per square league for pasture lands, or lands suitable for raising cattle.

Special provisions are made for the colonization of public lands by private individuals and companies.

In general, it may be said that the provisions of this land law are especially favorable to immigrants and parties seeking investments in any industry that may be profitably carried on in the Republic.

BRAZIL.

In 1891 the exports of coffee from Rio de Janeiro alone were 425,055,000, valued at $42,500,000 at 10 cents per pound. The exports from Santos are usually about one-half of those from Rio, and from these two ports the bulk of the coffee sent abroad is exported. The magnitude of the coffee growing interests in Brazil, and its importance in maintaining the national wealth and credit, may be estimated when it is considered that the United States alone paid to Brazil for her coffee in 1891 more that $45,000,000.

The profitable cultivation of coffee in Brazil is confined to the four states of Espiritu Santo, Minas-Geraes, Rio de Janeiro and São Paulo. It is produced as far north as Parã and in considerable quantities in Ceará, but the yield is less and the quality inferior to that of the product of the famous zone comprised in the four states just mentioned. The growth of coffee culture has been natural and remarkably rapid. No favors from the government, such as have been given to sugar production, no inducements to immigration on the part of national or state governments have contributed to the remarkable development of this great agricultural interest; but the natural adaptation of the soil and the growing demand for this staple have been sufficient to increase its exportation from thirteen bags in 1800 to the enormous quantities that annually load the vessels of all nations in the ports of Rio and Santos. The facilities for transportation from the interior to the coast have been a great factor in this increase, no doubt, as well as the moderate rates of freight on the railroads that have their termini in these ports.

The plantations are generally made on hillsides, from which the heavy forest growth has been cleared by felling the trees and burning off the undergrowth. The valuable logs are sometimes sawed on the spot into boards and planks; sometimes burned, after drying, and sometimes allowed to lie on the ground and decay. The latter method is perhaps the best, as the logs contain the wealth of the soil accumulated during years, which is thus returned to it again. As the cultivation is done altogether with hoe, spade and mattock, these decaying trunks are not so much in the way as might be supposed. All the vegetable growth that can be kept on the ground and does not interfere with the growing coffee trees aids in preventing the

washing away of the mold from the soil, which a bare cultivation would carry off in a few years.

A plantation, properly managed, lasts for about thirty years in profitable bearing, and by that time the soil is worn out, as is attested by the many bald, red hills to be found in the older cultivated districts of the coffee zone.

The young plants are sometimes raised in seed beds, as described in speaking of coffee culture in Mexico: sometimes young shoots from the roots of old trees are employed, and sometimes the more expensive, but better, method is resorted to of raising each plant in a separate earthen pot, whence, at one year old, it is transplanted with all the earth about its roots to its permanent location. Long rows of these pots with their plants, set on a slope, over which water is constantly running, and protected from the hot rays of the sun by matting stretched on poles above them, may be seen on the plantations where the best methods are employed. The system is costly, but about a year is gained in the growth of the trees, and the plants, receiving no check by transplanting, rarely need replacing. It has been found advantageous also to select the very best grains for seed, and some planters have succeeded in establishing improved and distinct varieties, by repeated reproduction from the same kinds of seed.

Nowhere in the world is greater attention given to the cultivation and handling of coffee than in Brazil, and nowhere else is improved machinery for the preparation of the crop for market so generally employed. It is the fashion in praising the coffee of other countries to describe it as superior to the Brazilian, but no permanent advantage is gained by unjust comparisons, for they are against the facts. The truth is that no coffee anywhere in the world is superior to the Brazilian, which is sold everywhere as Java, Mocha, Maracaibo, etc., at the fancy of the dealer and whim of the consumer. Every plantation in the country produces the Java and Mocha of the markets of the United States, and it is only an affair of sieves of differently sized meshes to classify the products of Brazilian plantations into the falsely named kinds, in order to demand a higher price from the buyer. These facts can not be controverted any more than can the other truth that no country produces coffee superior to that of Brazil. The coffee with a small, round grain, called, generally, "pea-berry," and sold in the United States as "Mocha," is produced

by topping and severely pruning the ordinary plant, although many such grains will always be found on trees treated in the usual manner.

While the young trees are growing, crops of corn or mandioca are sometimes raised between the rows, which are planted in the quincunx order, and these crops are sometimes sufficient to repay the expenses of the plantation. At the age of four years the trees are about six feet high and in profitable bearing, The principal gathering month is November, and then every available hand is engaged in picking the berries in baskets. The average result of a day's gathering for each person is enough to produce about fifty pounds of dried coffee. The baskets are emptied of their contents into carts which convey the berries to the mill-house, where they are to be prepared for market.

The berry resembles very closely the cranberry, and contains two grains with their flattened sides toward each other. Each of the two is covered with a closely adhering membrane called *pergaminho*, and outside of this is a thicker and more loosely fitting coat called *casquinho*. The two grains with their coverings are contained in a tough shell called *casco*, and this is surrounded by a white pulp and outer skin, thus forming the berry.

To prepare the coffee for market, all these coverings must be removed. The outer pulp is removed, after maceration in water, by a machine called *despolpador*, which consists of a revolving iron cylinder set with teeth and covered on one side by a concave sheet of metal.

A trough lined with cement is placed on a hillside above the mill, and through it a stream of water is kept running. Into this the coffee berries are thrown and are carried down by the stream into a large vat. In this vat the heavier berries sink to the bottom, whence they are drawn off through a pipe to the *despolpador*. This machine removes the pulp, the berries passing with the water to another vat beyond. In this the water is kept in constant motion by a revolving wheel, and the pulp is thus thoroughly washed off and carried away with the water, while the coffee grains sink to the bottom; and thence passing to a strainer the water is all drained off, leaving them ready for the process of drying.

Two methods of drying are in use; the old process, which consists in spreading the grains on a cement-covered pavement called *terreiro*, where they are allowed to dry in the sun. For this about two months are necessary, and the grains have to be raked over and

turned during the day and gathered into piles and covered at night. Whenever a shower comes up the coffee must also be covered. The more modern and satisfactory process of drying by steam is employed on many of the larger plantations. By this process the drying, which by the old method requires about sixty days, is accomplished in a few hours, with a vast economy of labor. Under this system drying is done in large, shallow pans of zinc heated by steam coils beneath. This process will, doubtless, on large plantations, supersede the older and more expensive method. The drying is done more uniformly and with no danger of injury from sudden rain.

The coffee, after drying, is still inclosed in the inner and outer skins, which have been rendered more brittle by the drying. The machinery necessary for the removal of this is somewhat complicated and expensive. The most efficient of the machines in use are from the United States, and a complete plant for a large plantation will cost not less than $25,000. The coffee is brought from the drying house and placed in bins, whence, by an elevator band, it is carried to a ventilator, where it is rid of rubbish and dust by sifting and fanning. From the ventilator the coffee is carried to the sheller (*descascador*), which consists of a toothed cylinder, by whose rapid revolutions the outer and inner husks are broken. The grains and broken husks are carried by a pipe to a second ventilator, where the latter are sifted out and fanned away, and the former are carried by an elevator to the separator. This is composed of hollow copper cylinders, pierced with holes of different shapes and sizes. These cylinders are kept constantly revolving, and the coffee grains, passing through the holes, fall into separate bins, being thus assorted according to their size and shape.

The coffee thus mechanically classified goes into the markets of the world, where it is sold, the small, round grains as Mocha, the large flat grains as Java, and so on, until all the coffee-producing countries are represented in all the corner groceries of the world by the product of a single Brazilian plantation.

A small portion of the *pergaminho* which still remains is removed by the *brunidor* (polisher) by trituration and fanning. Finally, after passing through all this series of machines the coffee is carefully picked over by hand and is ready to be put into bags.

Although immense tracts of land suitable for coffee culture yet remain unoccupied, nearly all of them are held by large land owners

who generally refuse to sell. As there is no tax on land and a considerable one on land sales, the owners prefer to hold them, as the constant demand for coffee lands annually enhances their value, and they can be held with no expense to their owners. Good coffee lands when sold bring large prices, and no person can engage in coffee raising without considerable capital. As has been said the coffee zone embraces the states of Espirito Santo, Rio de Janeiro, Minas-Geraes and São Paulo, and the greater part of the unoccupied public lands are situated in the other states.

Under the new constitution of Brazil all wild lands formerly belonging to the Empire are declared to be the property of the states within whose limits they lie, and their sale is governed by the various regulations established by the respective legislatures.

ECUADOR.

Coffee is the third in value of the exports of Ecuador, though its production has not reached the importance attained in most of the other coffee-producing States of America. But little information concerning its cultivation has been accessible to this Bureau, but it may be said that the methods of planting, cultivating and gathering are the same as in the neighboring countries.

There are, undoubtedly, large bodies of lands in the Republic suitable for coffee culture, and the Secretary of the Treasury, in a report submitted to the Congress of Ecuador, states that the government possesses vast tracts of great fertility that are valueless for want of occupants. These lands lie on the eastern and the western slopes of the Andes and their difficulty of access is the chief obstacle to their settlement. The price of public lands sold by the government is from 20 to 80 cents per acre, and not more than 500 acres will be sold at one time to one individual.

BOLIVIA.

Bolivia must be reckoned among the coffee-producing countries of America, and although the exportation of that product has not reached the proportions attained in some of the neighboring countries, the quality is of undeniable excellence. Mention may be made of the famous coffee of Yungas which rivals the Mocha in excellence.

The coffee-producing lands are situated in the province of Puna-

taand in the departments of Santa Cruz, Veni and La Paz. The mountainous character of the country, while favorable in many respects to the selection of sites for coffee plantations, renders transportation so difficult that it constitutes the chief obstacle to the opening of lands, and the day is probably distant when the steam car shall take the place of the slow mule train. The same methods of opening and cultivating coffee plantations prevail here as in the other coffee-raising countries and their production is about the same; but no statistics are available to show the price of labor and other expenses of handling and marketing.

THE GUIANAS AND WEST INDIES.

The Guianas and most of the larger West India Islands produce greater or less quantities of coffee. In the year 1890–91 the island of Jamaica exported coffee to the amount of $1,381,114, and Puerto Rico to the value of 4,858,306 pesos; in 1888 Guadalupe exported 905,368 francs' worth. Coffee culture was formerly an important interest in Martinique. It is probable that no great increase in the coffee product of the West Indies is to be looked for for many years, and the markets of the world must continue to obtain their supplies from the continental countries treated of in the foregoing pages.

JAMAICA

Exports annually from 800,000 to 900,000 pounds of coffee. The value of the exports of this article in 1891 was about one-sixth of the total export. More than half the coffee exported is taken by the United States, but consists chiefly of the lower grades, the better and higher-priced qualities going to England. The best coffee of the island is raised in the eastern part of the parishes of St. Andrew and St. Thomas, and goes almost entirely to England. The coffee of Jamaica, like that of Haiti, is of fair quality, a little stronger than Java and milder than Rio. The greater part of the product is raised by negroes, who own from one-half an acre to five acres of ground, where the trees are planted without order or system and receive little attention.

The number of plantations where as much as fifty acres are cultivated in coffee is only thirty. In the preparation of the coffee

for market, the most primitive means are employed, the cost of machinery for that purpose being beyond the means of the small growers. The berries, after picking, are dried on the ground, and the outer skins are removed by beating in large wooden mortars. On the larger plantations more care is given to the preparation of the ground, and the plants are set at regular distances, generally six feet apart. Being planted so near together, it is necessary to top the trees when they reach the height of about four feet, and by annual pruning to keep them from crowding each other. The plantations are weeded with a hoe at least four times every year, as without this weeding the ground would soon be overgrown with grass and plants that spring up with marvelous rapidity in that tropical climate.

Jamaica appears not to offer any inducements to settlers proposing to embark in coffee culture. Lands suitable for the growing of coffee on a large scale are difficult to obtain, and suitable labor still more so.

HAWAIIAN ISLANDS.

Coffee has been raised in Hawaii and the other islands of the group for many years, although the production has varied greatly and has never been sufficient to supply home consumption. It appears from the records of the custom-house that in 1870 the exportation amounted to 415,111 pounds, and in 1885 fell to 1675 pounds. For nine months of 1892 the exportation was 13,098 pounds. The total exportation since 1881 has been 215,782 against an importation of 877,409 pounds.

New enterprises are on foot for the planting of lands in coffee. In the Hamakua and North Hilo districts, about 170 acres are already planted. In the district of Puna about 100 acres are growing, and it is estimated that about 1300 acres are planted in coffee on the island of Hawaii. These are mostly new plantations, the greater part of which will soon come into bearing.

The first plantations made in the island were only a few feet above sea level, and to this fact may, perhaps, be attributed the blight which almost destroyed their production about 1860, since the plantations more recently established at an elevation of 1000 and upwards have been almost entirely free from blight. The high rate of wages, the cost of transportation and the difficulty of buying or leasing suitable land for a long term are the greatest obstacles to the development of the coffee-producing capacity of the islands.